AN INNOVATIVE APPROACH TO STUDY THE IMPACT OF DIFFERENT BLENDS OF LEARNING ON LEARNING PERFORMANCE IN HIGHER EDUCATION

Thuy N. T. Thai[1], Bram De Wever[2], Martin Valcke[3].
Department of Educational Studies, Ghent University, H. Dunantlaan 2, 9000 Ghent, Belgium

Abstract

This study investigates the differential impact of blended learning (BL), face-to-face (F2F) and eLearning (EL) on learning performance (LP), also considering the effect of particular variables (self-efficacy (SE), intrinsic motivation(IM) and flexibility). Students were randomly allocated to one of the four experimental conditions (n F2F=22, n BL1=22, n EL=23, n BL2=23). Analysis of covariance (ANCOVA) was applied to study the differential impact of teaching approaches. The results reflect a significant difference in LP after studying in a particular higher education setup [$F(3,86) = 9.44$, $p<.001$], $R^2=22.1$. Learning performance was superior in both blended learning conditions. Though the different teaching setups resulted in small significant differences in mediating variables, these did not interact significantly with the research conditions. Based on the present findings, blended learning instruction could be put forward as a promising alley to enhance students' performance.

Key words: Blended Learning, eLearning, Face-to-Face, Web based Lecture, Learning Performance

1 INTRODUCTION

There is growing research evidence about the impact of eLearning (EL) (Cho & Kim, 2013; Kuo, Walker, Schroder, & Belland, 2014). The rationale for implementing eLearning solutions varies from a focus on flexibility and efficacy to satisfaction parameters. At the same time, the research refers to eLearning as an ingredient in mixed higher education setups, mostly labeled "blended learning" (BL). Blended learning is the combination strengthens between EL and F2F components (Garrison & Kanuka, 2004; Bonk & Graham, 2012; Osguthorpe & Graham, 2003). In the literature, it is often difficult to come to clear conclusions as to the differential impact of EL versus BL and F2F, due to large differences in the design of the higher education setups and related research designs. Therefore, we focus on studying the differential impact of two types of BL, versus F2F and EL while keeping many other variables under controlling and applying the same research instruments. In the present contribution, we first discuss key concepts that play a role in the theoretical base: eLearning (EL), face-to-face learning (F2F) and blended learning (BL). Next, we discuss BL design elements taken into account in the present study: (1) lectures and (2) guiding questions. Additionally, we discuss a number of mediating variables that will be considered in a quasi-experimental pretest-posttest research design.

2 THEORETICAL AND CONCEPTUAL BASE

2.1 Types of learning environments

eLearning is defined as the integrated use of Information and Communication Technologies (ICT) in learning and teaching (Jurado, Redondo, & Ortega, 2012; Oztekin, Delen, Turkyilmaz, & Zaim, 2013). EL is hypothesized to improve the quality of higher education by improving flexibility in access to resources and services; e.g., group discussion, interactions between students and teachers, distributions of materials (Martínez-Torres, Toral, & Barrero, 2011b).

Face-to–face learning puts the instructor and learners at the same time in the same geographical location (Redmond, 2011). The student-teacher interaction is at the heart of the teaching process. Wond (2005) stresses the importance of interaction with instructors. Students can communicate directly with teachers to get immediate feedbacks and guidance. Smyth, Houghton, Cooney, and Casey (2012) stress how F2F learning provides ample opportunities for social interaction between students as a base for the learning process.

As defined by many researchers, blended learning combines face to face learning and eLearning (Garrison & Kanuka, 2004;; Osguthorpe & Graham, 2003;). Owston, York, & Murtha (2013) stress that BL provides learning opportunities for students . Others report about the positive impact of BL on student satisfaction and related academic achievement (Deperlioglu & Kose, 2013; Glogowska, Young, Lockyer, & Moule, 2011). Some studies have contrasted BL to traditional F2F courses and report significantly higher performance in the BL setting (Vernadakis, et al., 2012; Wu, et al., 2010). (Wu, Tennyson, & Hsia, 2010) Based on the available literature, we will put forward the hypothesis that studying in a BL setting will result in higher LP as compared to studying in a F2F or a EL setting.

2.2 Blending El and F2F: deisgn elements

In the present study, we try to build on the strengths of both EL and F2F when developing a potentially rich blend for BL. We therefore discuss some evidence-based instructional practices that will consistently be implemented in alternative learning environments: lectures and guiding questions.

Traditional face-to-face lectures are often a key component of teaching in higher education. Lectures seem to be helpful to effectively transfer declarative information to learners Beale, Tarwater and Lee, 2014; Berkowitz, 2013; Frederick, 1986; Bligh, 1998). They are successful to invoke critical thinking about a discipline. Berkowitz (2013) stresses that attending lectures is positively associated with academic performance. Lectures are additonally supported with PowerPoint slides and printed text. Web-based Lectures (WBL), are the EL-alternative of F2F lectures. WBL can be defined as lectures that have been digitally recorded and can be streamed via the Internet (Gosper et al., 2010). WBL support reviewing difficult concepts, revising for an exam or listening to missed classes (Williams & Fardon, 2007).

Guiding questions are defined as a tool to push student understanding. Traver (1998) argues that guiding questions can lead learners to higher, more meaningful learning and achievement. According to (Blosser, 2000), guiding questions help students to review learning content, check their comprehension, stimulate critical thinking, encourage creativity. Available research evidence clearly states that guiding questions have a positive effect on student performance (Budé, van de Wiel, Imbos, & Berger, 2012).

In the present study we will present lectures and guiding questions as the key ingredients completely online (EL condition); completely face-to-face (F2F condition); lectures online and guiding questions face-to-face in a first blended learning condition (BL1) and lectures face-to-face and guided questions online (BL2).

2.3 The role of mediating variables

Whereas we consider learning performance as the key dependent variable in the present study, the present research also focuses on the mediating impact of: self-efficacy (SE), intrinsic motivation (IM) and flexibility (FL).

Self-efficacy refers to an individual's belief in one's capacity to execute behaviors necessary to produce specific performance attainments (Benight & Bandura, 2004)Self-efficacy reflects confidence in the ability to exert control over one's own motivation, behavior, and social environment. In a blended learning environment,Zajacova, Lynch, & Espenshade, (2005) reported that self-efficacy related significantly to student performance. The same applies to research focusing on the mediating impact of self-efficacy in eLearning contexts (Wu and Tsai, 2006).

Intrinsic motivation refers to motivation that comes from an individual's internal desire for self-satisfaction rather than from any external or outside rewards such as money or grades (Ryan & Deci, 2000). In blended learning environments, students' self-motivation has been observed to increase because of losing less time in class and due to a stronger emphasis on self-regulated learning (So & Brush, 2008). Méndez and Gonzalez (2011) stress that compared to F2F, intrinsic motivation increases in a BL setting. In eLearning contexts, intrinsic motivation influences to learning process and resulting academic performance (Joo, Lim, & Kim, 2012).

Flexibility is defined as giving choice in key questions of students as to when/where/ and what to learn (Colis, 1997). Flexibility is a key dependent variable in most eLearning and BL research. In Blended Learning environments, the face-to-face component supports for social interaction, while the eLearning component supports freedom in choosing when and where to study (Deperlioglu & Kose, 2013; Smyth, Houghton, Cooney, & Casey, 2012). Blended learning supports the positive opportunities for collaborative learning, students can participate in group activities to share their thoughts (Snodin, 2013). In view of our research, we hypothesize that flexibility will be higher in an EL or a BL setting as compared to a F2F learning condition.

3 RESEARCH DESIGN

A quasi-experimental pretest-posttest research design was set up to study the differential impact of four different learning designs (traditional F2F, complete eLearning (EL) and two BL alternative designs), considering the mediating influence of mediating variables (SE, IM and flexibility). The four research conditions build on the same course content, the same theoretical base and on the same key didactical design guidelines: lectures and guiding questions and involve students from the same research population.

3.1 Hypotheses

- H1: Studying in a BL learning environment will result in higher learning performance as compared to studying in an eLearning or a face-to-face instruction setting.
- H2: Studying in a BL learning environment will result in higher learning performance as compared to studying in a eLearning or a face-to-face instruction setting, considering changes in SE, IM and/or perceived flexibility.

3.2 Participants

Respondents were second-year undergraduate students (n=90), enrolled in the “Invertebrates” course of the School of Education at Can Tho (Vietnam). Student age ranged from 20 to 22 years (M= 20.48, SD= 0.67). Informed consent was obtained of every individual student.

3.3 Instruments

Two tests were designed to measure learning performance. Test items in both tests reflected the same behavioral levels, despite slight differences in the content of the questions. Test administration took 30 minutes to determine pretest and posttest Learning Performance. The tests were scored on 10.

Self-efficacy (SE), Intrinsic Motivation (IM) and Flexibility (FL) instruments

Both at the start and at the end of the study, students were presented with a survey, focusing on SE, IM and flexibility. Self-efficacy (SE) was measured with 27-item scale of (Zajacova et al., 2005) with figures range from 0-100. Intrinsic motivation (IM) was determined on the base of the translated 12-item scale of Vallerand et al. (1993). To determine the level of experienced flexibility, the 15- item scale of Colis (1997) was presented to respondents. Both intrinsic motivation and flexibility items were rated on a 5-point Likert scale.

3.4 Procedure

Participants were randomly posited to one of the four experimental conditions (F2F n=22; BL1 n=22: EL n=23; BL2 n=23). The first week started with a course introduction, allocating students to the research conditions, and the administration of the pretest and survey to the students. The next four weeks consisted of 4 weekly sessions. Each structured session was planned to take on average 90 minutes and always consisted of two parts. The first part (estimated to take 45 minutes) focused on the delivery of a lecture (WBL or F2F), the second part (estimated at 45 minutes) focused on solving guiding questions (individually, on paper or in an online group forum; see below). In the last week, students were presented with the posttest and final survey and participated in focus groups. The study was set up during the first 6 weeks of the second semester 2014-2015.

3.5 Description of the different research conditions

In this study, we contrast face-to-face (F2F), eLearning (EL) and two blended learning conditions (BL1 and BL2). Guiding questions and the lecture differed in their delivery mode, pending the research condition.

In addition to the EL and F2F settings, two different BL settings were organized. In BL1, students received the lecture face-to-face, studied the text on paper and solved the guiding questions individually in the online forum. In BL2, students received a web-based lecture, studied the printed reader and solved individually the printed guiding questions in a face-to-face setting at the end of the reader.

3.6 Analysis approach

SPSS was used for statistical analysis. Analysis of covariance (ANCOVA) was applied to test both hypotheses; considering the mediating variables as defined by the hypothesis. Post hoc analyses were carried out to investigate the structure in the differences between the four research conditions. Assumptions were tested in view of statistical analyses (homogeneity of variance). A significance level of $p < .05$ level was put forward.

4 RESULTS

4.1 Descriptives

Table 1 presents a summary of the means and standard deviations of the dependent variable (Learning performance, LP) and the mediating variables, SE, IM and perceived flexibility. As explained above, difference scores were calculated to test the impact of the intervention.

Table 1. Descriptives (mean and standard deviation) of Learning Performance (posttest-pretest) and the mediating variables (N=90)

	F2F		BL1		EL		BL2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
LP_DIFF	2.29	1.33	2.69	1.35	1.68	1.11	3.66	1.36
SE_DIFF	.606	8.66	3.30	6.56	-3.86	14.24	4.92	6.75
IM_DIFF	-.110	.367	-.163	.358	-.457	.860	-0.40	.556
FL_DIFF	-.024	.419	.066	.400	.043	.503	.130	.336

4.2 BL results in higher learning performance as compared to EL and F2F

To study the differential impact on learning performance, a one-way between subjects ANOVA was carried out, with the conditions as factor (F2F, BL1, EL, and BL2). We found a significant effect on learning performance ($F(3,86)$ = 9.44, p<.001). Studying in a different condition accounts for 22.1% of explained variance in learning performance. Building on these results, we can accept the first hypothesis. Post hoc analysis points out that BL2 learning performance is significantly higher as compared to other learning conditions (BL2 versus F2F: *M_DIFF*=1.37, p<.01; BL2 vs EL: *M_DIFF*=1.98, p<.01). However, there was no significant difference mean between BL2 and BL1 (*M_DIFF*=0.97, p=.119).

4.3 BL results in higher learning performance, considering changes in SE, IM and perceived flexibility.

Analysis of co-variance was carried out, comparing differences in learning performance, but considering the impact of the mediating variables (self-efficacy, intrinsic motivation, flexibility). The results of the one-way between subjects ANOVA reiterate the significant differences between the research conditions (F(3,86) = 11.94, p<.001). But, this effect does not seem to be mediated by the differences in changes in self-efficacy, intrinsic motivation or experienced flexibility. The analysis results suggest rejecting the second hypotheses.

As an extension to the testing of the hypothesis, we also checked whether – independent of changes in learning performance – the conditions also resulted in significant changes in mediating variables.

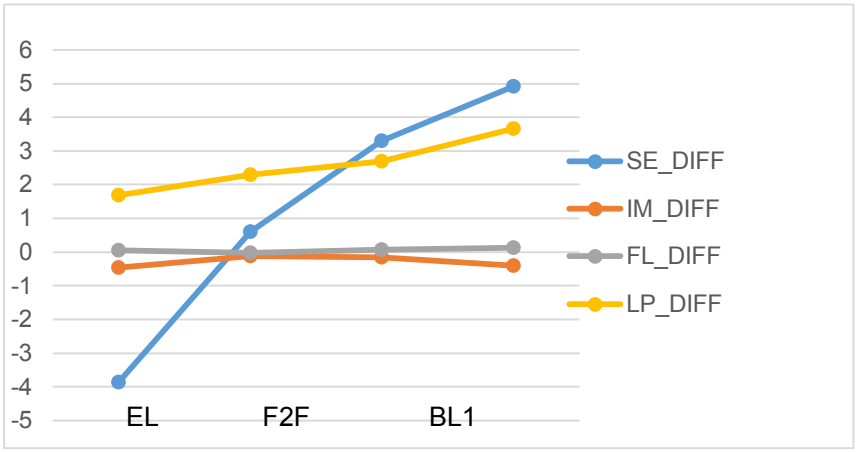

Figure 1. Differences in changes in learning performance, self-efficacy, intrinsic motivation and experienced flexibility (N=90).

Figure 1 depicts the differences in changes in the three key mediating variables: self-efficacy, intrinsic motivation and experienced flexibility. As to self-efficacy, the descriptive results show very large and significant differences between the research conditions ($F(3,86)=3.66$ $p<.05$). Post hoc comparisons, using LSD show that BL2 results in significantly higher self-efficacy as compared to EL (*M_DIFF*=8.79, $p<.01$). Also, BL1 results in significantly higher self-efficacy after the intervention as compared to studying in an EL context (*M_DIFF*=7.16, $p< .05$). No significant differences are observed between research conditions in the mediating variables intrinsic motivation and perceived flexibility.

5 DISCUSSION AND CONCLUSIONS

The main aim of the present study was to evaluate the impact of four different learning arrangements on learning performance, and the mediating impact of self-efficacy, intrinsic motivation and perceived flexibility. In this research design, we contrasted two blended learning approaches with F2F and EL.

The analysis results suggest accepting hypothesis 1, considering the significantly higher performance attained when studying in the Blended Learning condition 2, as compared to F2F, EL and BL1. The result indicate that students studying a web based lecture and solving guiding questions in a face-to-face settings seem to be superior in view of attaining academic performance. This finding is consistent with other research (Suda, Sterling, Guirguis, & Mathur, 2014; Vernadakis et al., 2012), especially when focusing on the difference between BL and F2F. In addition, it is remarkable that BL2 is superior to BL1; though the only difference between the two designs is in the switch between delivery mode of the lecture and the guiding questions. The fact the web-based lecture seems to have a superior impact is in line with research findings about EI versus F2F lectures (Wieling and Hofman, 2010). Our results also indicate there are no significant differences between students studying in a F2F versus an EL setting.

With respect to the impact of the mediating variables and co-variables on learning performance, no interaction effect could be identified. First, it has to be stressed that, at a basic level, no changes in intrinsic motivation and flexibility were identified between the research conditions. Only in relation to self-efficacy a significant differential impact was observed.

A number of limitations has to be addressed. The short duration of the intervention was linked to a lack of experience in getting acquainted with the newly introduced LMS at Can Tho University. Analysis of resulting data could help explaining why e.g. the mediating variables play – yet – a limited role. A third limitation is the little attention paid to student background (e.g., working students, professionals taking HE courses). Especially in view of studying the mediating impact of the variable flexibility, the current study only involved regular higher education students.

In this study, the results point at a promising differential impact of blended learning on learning performance. Especially the combination of web based lectures and guiding questions seemed to be successful ingredients to make a difference in terms of attaining learning performance. Though the mediating impact of self-efficacy, intrinsic motivation and flexibility could yet not be empirically grounded, clear directions for future research could be presented to inspire innovative blended learning practices in higher education.

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